



High-Speed, CMOS, Quad, SPST Analog Switch

HI-201HS

General Description

Maxim's HI-201HS is a monolithic, CMOS, quad, single-pole-single-throw (SPST), high-speed analog switch featuring fast switching times (t_{OFF} , $t_{ON} \leq 50\text{ns}$) and low on resistance (50Ω max). It is pin compatible with the industry-standard DG201A.

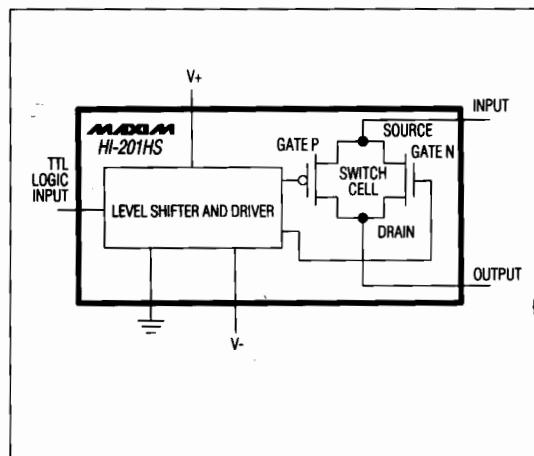
Maxim's new high-voltage silicon-gate technology increases the maximum supply-voltage rating to 44V. This improvement allows continuous operation with $\pm 20\text{V}$ supplies, which is not permitted with the original manufacturer's devices. Maxim's HI-201HS operates from dual supplies ranging from $\pm 5\text{V}$ to $\pm 20\text{V}$, or from single supplies from $+12\text{V}$ to $+20\text{V}$. Logic levels are TTL-/CMOS-compatible with single or dual supplies within these ranges.

Maxim's HI-201HS is guaranteed not to latch up if power supplies are disconnected while the analog-switch inputs are present, provided the switch continuous-current ratings are not exceeded. When powered up, the HI-201HS will switch analog signals up to the power-supply rails.

Applications

- Automatic Test Equipment (ATE)
- Heads-Up Displays
- Communication Systems
- Sample-and-Hold Circuits
- Military
- Integrator Reset Circuits

Functional Diagram



Features

- ◆ Guaranteed Single-Supply Operation: $+12\text{V}$ to $+20\text{V}$
- ◆ Guaranteed Dual Supplies: $\pm 5\text{V}$ to $\pm 20\text{V}$
- ◆ Fast Switching Times:
 - $t_{ON} = 30\text{ns}$
 - $t_{OFF} = 40\text{ns}$
- ◆ Low, 50Ω Max On Resistance
- ◆ TTL-/CMOS-Compatible
- ◆ 44V Max Supply Rating

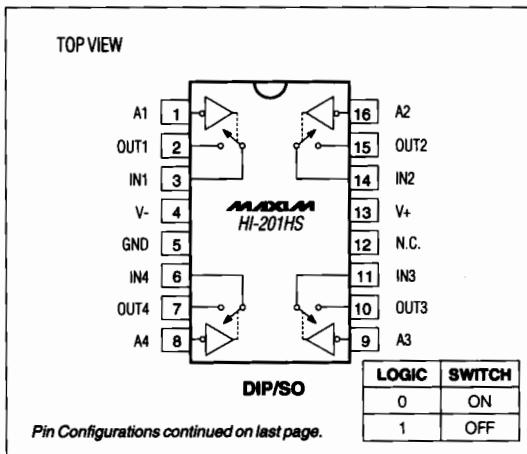
Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE
HI3-0201HS-5	0°C to $+70^\circ\text{C}$	16 Plastic DIP
HI6-0201HS-5	0°C to $+70^\circ\text{C}$	16 Narrow SO
HI1-0201HS-5	0°C to $+70^\circ\text{C}$	16 CERDIP
HI0-0201HS-6	0°C to $+70^\circ\text{C}$	Dice*
HI3-0201HS-9	-40°C to $+85^\circ\text{C}$	16 Plastic DIP
HI6-0201HS-9	-40°C to $+85^\circ\text{C}$	16 Narrow SO
HI1-0201HS-9	-40°C to $+85^\circ\text{C}$	16 CERDIP
HI1-0201HS-2	-55°C to $+125^\circ\text{C}$	16 CERDIP
HI4-0201HS-8	-55°C to $+125^\circ\text{C}$	20 LCC**

* Contact factory for dice specifications.

** Contact factory for availability.

Pin Configurations



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ABSOLUTE MAXIMUM RATINGS

Voltage Referenced to V-		Continuous Power Dissipation (TA = +70°C, Note 2)		
V+	44V	16-Pin DIP (derate 10.53mW/°C above +70°C)		842mW
GND	25V	16-Pin Wide SO (derate 9.52mW/°C above +70°C)		762mW
Digital Inputs VS, VD (Note 1)	(V- - 4V) to (V+ + 4V) or 30mA (whichever occurs first)	16-Pin CERDIP (derate 10.00mW/°C above +70°C)		800mW
Current (any terminal, except S or D)	30mA	20-Pin LCC (derate 9.09mW/°C above +70°C)		727mW
Continuous Current, S or D	20mA	Operating Temperature Ranges:		
Peak Current, S or D (pulsed at 1ms, 10% duty cycle max)	40mA	HI-0201HS-5/-6	0°C to +70°C	
		HI-0201HS-9	-40°C to +85°C	
		HI-0201HS-2/-8	-55°C to +125°C	
		Storage Temperature Range	-65°C to +150°C	
		Lead Temperature (soldering, 10sec)	+300°C	

Note 1: Signals on Sx, Dx, or INx exceeding V+ or V- are clamped by internal diodes. Limit forward current to maximum current ratings.

Note 2: All leads soldered or welded to PC board.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

(V+ = 15V, V- = -15V, GND = 0V, TA = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	HI-201HS-2/-8			HI-201HS-5/-6/-9			UNITS
			MIN (Note 3)	TYP (Note 4)	MAX	MIN (Note 3)	TYP (Note 4)	MAX	
SWITCH									
Analog-Signal Range	V _{ANALOG}		-15	15	-15	15	1	1	V
Drain-Source On Resistance (Note 5)	r _{DS} (on)	V _D = ±10V, V _{IN} = 0.8V, I _S = 1mA	30	50	30	50	1	1	Ω
Source-Off Leakage Current	I _S (off)	V _{IN} = 3.0V	-1	±0.01	1	-1	±0.01	1	nA
		V _S = 14V, V _D = -14V	-1	±0.02	1	-1	±0.02	1	
Drain-Off Leakage Current	I _D (off)	V _{IN} = 3.0V	-1	±0.01	1	-1	±0.01	1	nA
		V _D = 14V, V _S = -14V	-1	±0.02	1	-1	±0.02	1	
Drain-On Leakage Current (Note 6)	I _D (on)	V _D = -14V, V _{IN} = 0.8V	-1	±0.10	1	-1	±0.10	1	nA
		V _D = 14V, V _{IN} = 0.8V	-1	±0.15	1	-1	±0.15	1	
LOGIC INPUT									
Input Current with Input Voltage High	I _{INH}	V _{IN} = 3.0V	-1	0	1	-1	0	1	μA
		V _{IN} = 15V	-1	0	1	-1	0	1	
Input Current with Input Voltage Low	I _{INL}	V _{IN} = 0.8V	-1	0	1	-1	0	1	μA

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ELECTRICAL CHARACTERISTICS (continued)

(V₊ = 15V, V₋ = -15V, GND = 0V, T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	HI-201HS-2/8			HI-201HS-5/6/9			UNITS
			MIN (Note 3)	TYP (Note 4)	MAX	MIN (Note 3)	TYP (Note 4)	MAX	
DYNAMIC									
Turn-On Time	t _{on}	Figure 6	30	50	30	50	30	50	ns
Turn-Off Time	t _{off}	Figure 6	40	50	40	50	150	150	ns
	t _{off2}		150						
Output Settling Time			180		180				ns
Charge Injection	Q	C _L = 1000pF, V _{GEN} = 0V, R _{GEN} = 0Ω	10		10				pC
Source-Off Capacitance	C _S (off)	V _S = 0V, V _{IN} = 5V	f = 140kHz	10		10			pF
Drain-Off Capacitance	C _D (off)	V _S = 0V, V _{IN} = 5V	f = 140kHz	10		10			pF
Channel-On Capacitance	C _D (on) ⁺ C _S (on)	V _D = V _S = 0V, V _{IN} = 0V	f = 140kHz	30		30			pF
Off Isolation		V _{IN} = 3VRMS, Z _L = 1kΩ, f = 100kHz		72		72			dB
Crosstalk (Channel-to-Channel)		V _S = 2.0V, f = 100kHz		90		90			dB
SUPPLY									
Positive Supply Current	I ₊	All channels on or off	-3.0	3.8	6.5	-3.0	3.8	6.5	mA
Negative Supply Current	I ₋			1.0		1.0			mA
Power-Supply Range for Continuous Operation	V _{OP}	(Note 5)	±4.5	±20	±4.5	±20			V

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ELECTRICAL CHARACTERISTICS

(V₊ = 15V, V₋ = -15V, GND = 0V, TA = T_{MIN} to T_{MAX}, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	HI-201HS-2/8			HI-201HS-5/6/9			UNITS
			MIN (Note 3)	TYP (Note 4)	MAX	MIN (Note 3)	TYP (Note 4)	MAX	
SWITCH									
Analog-Signal Range	V _{ANALOG}		-15	15	-15	15	15	15	V
Drain-Source On Resistance (Note 5)	r _{DS} (on)	V _D = ±10V, V _{IN} = 0.8V, I _S = 1mA		75			75	75	Ω
Source-Off Leakage Current	I _S (off)	V _{IN} = 3.0V	V _S = 14V, V _D = -14V	-100	100	-50	50	50	nA
			V _S = -14V, V _D = 14V	-100	100	-50	50	50	nA
Drain-Off Leakage Current	I _D (off)	V _{IN} = 3.0V	V _D = 14V, V _S = -14V	-100	100	-50	50	50	nA
			V _D = -14V, V _S = 14V	-100	100	-50	50	50	nA
Drain-On Leakage Current (Note 6)	I _D (on)	V _D = -14V, V _{IN} = 0.8V	-100	100	-50	50	50	50	nA
		V _D = 14V, V _{IN} = 0.8V	-100	100	-50	50	50	50	nA
LOGIC INPUT									
Input Current with Input Voltage High	I _{INH}	V _{IN} = 3.0V	-1.0	1.0	-1.0	1.0			μA
		V _{IN} = 15V	-1.0	1.0	-1.0	1.0			
Input Current with Input Voltage Low	I _{INL}	V _{IN} = 0.8V	-1.0	1.0	-1.0	1.0			μA
DYNAMIC									
Turn-On Time	t _{on}	See Figure 6			75		75	75	ns
Turn-Off Time	t _{off}	See Figure 6			75		75	75	ns
SUPPLY									
Positive Supply Current	I ₊	All channels on or off		10		10	10	10	mA
Negative Supply Current	I ₋	All channels on or off	6		6		6	6	mA

Note 3: The algebraic convention where the most negative value is a minimum and the most positive a maximum is used in this data sheet.

Note 4: Typical values are for DESIGN AID ONLY, not guaranteed or subject to production testing.

Note 5: Electrical characteristics, such as on resistance, will change when power supplies other than ±15V are used.

Note 6: I_{D(on)} is leakage from driver into on switch.

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Protecting Against Fault Conditions

Fault conditions occur when power supplies are turned off and input signals are still present, or when overvoltages occur at the inputs during normal operation. In either case, source-to-body diodes can be forward biased and conduct current from the signal source. If this current must be kept at low (μ A) levels, we recommend adding external protection diodes (Figure 1).

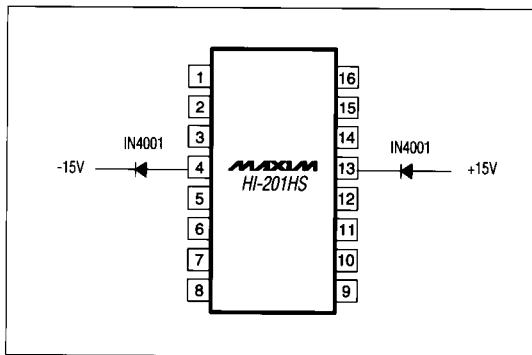


Figure 1. Protection Against Fault Conditions

To provide protection for overvoltages up to 20V above the supplies, place a 1N4001 or 1N914 type diode in series with the positive and negative supplies, as shown in Figure 1. Adding these diodes will reduce the analog-signal range to 1V below the positive supply and 1V above the negative supply.

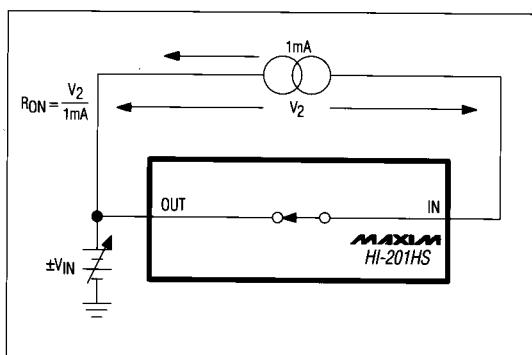


Figure 2. On Resistance

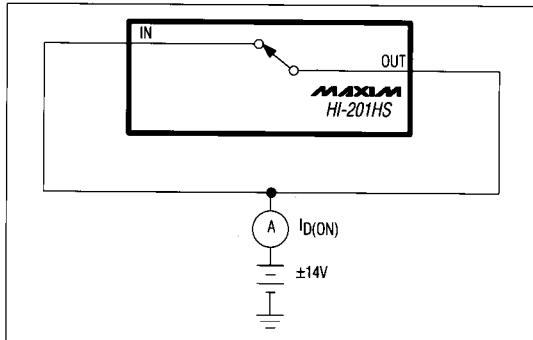


Figure 3. On Leakage Current

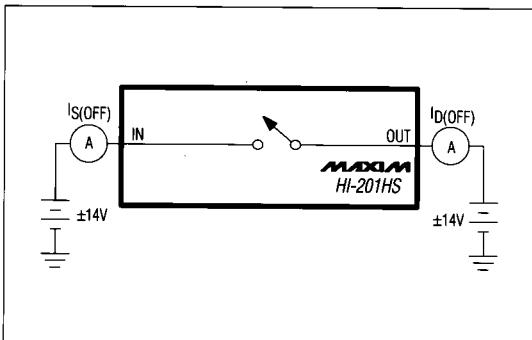


Figure 4. Off Leakage Current

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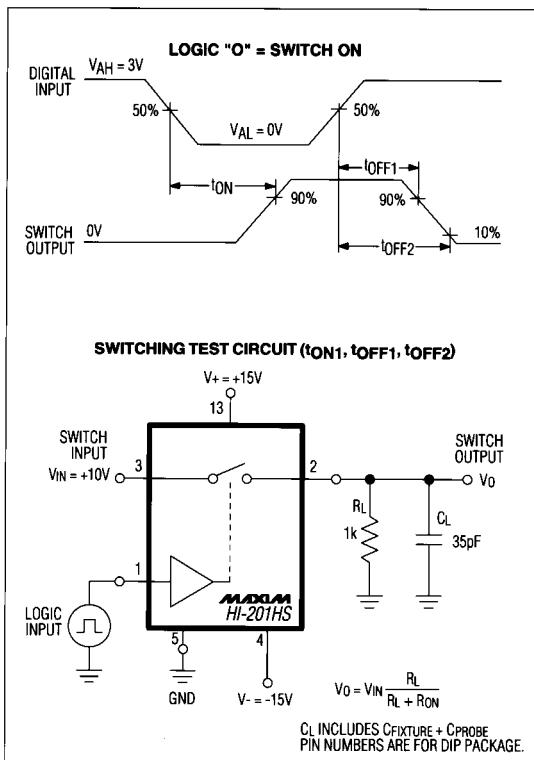
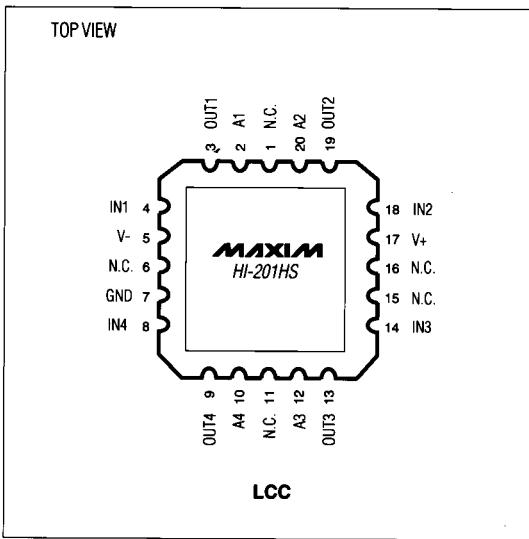


Figure 6. Switching-Time Test Circuit

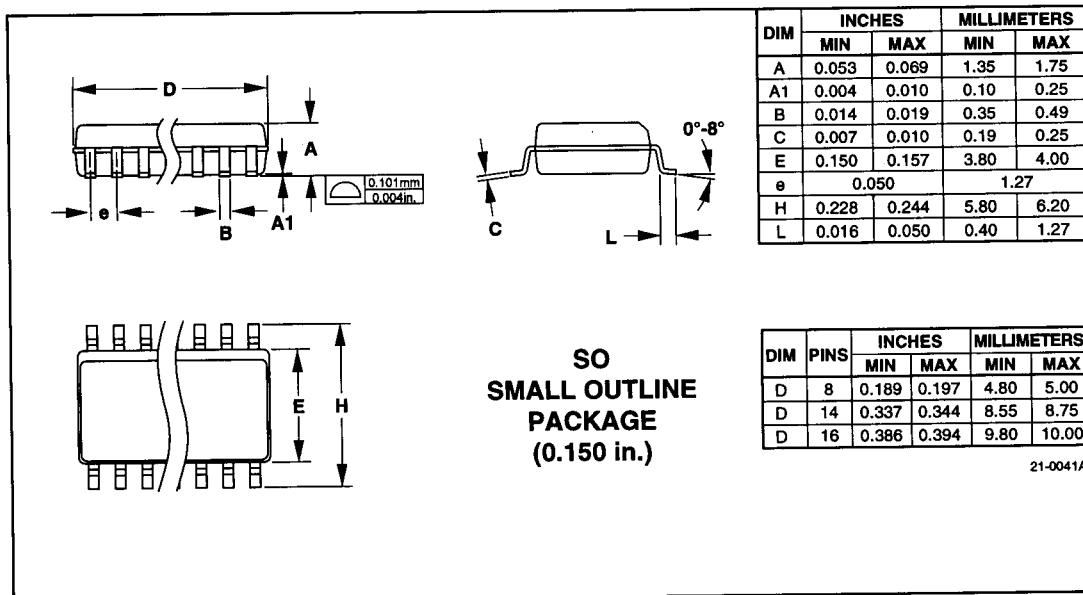
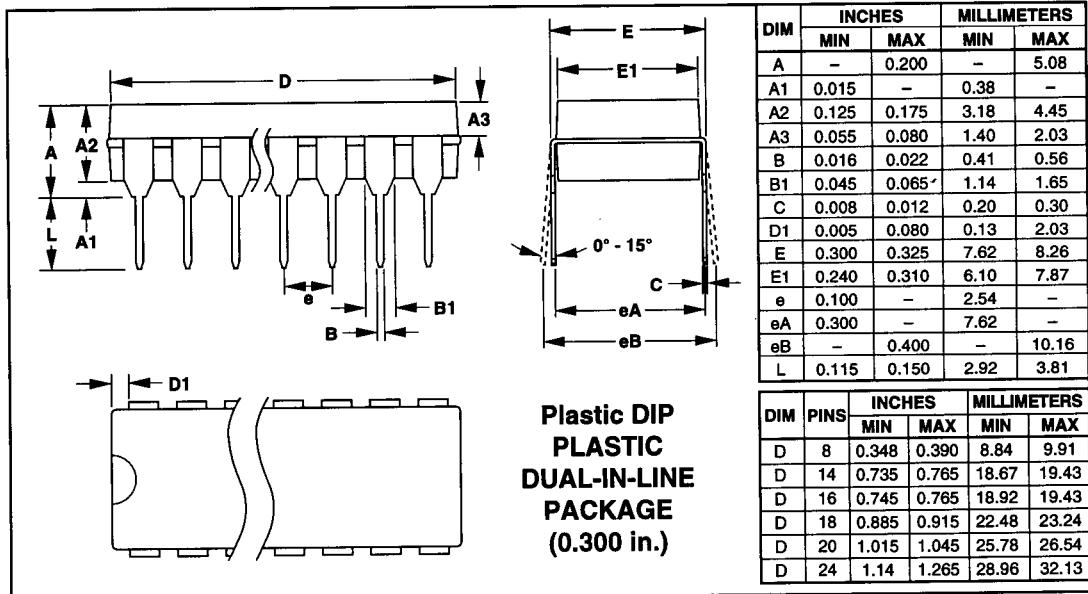
Pin Configurations (continued)



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Package Information

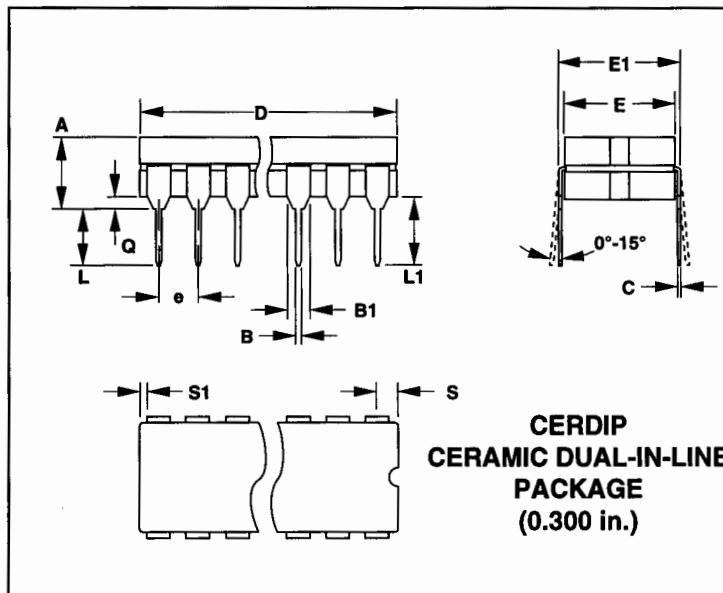
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Package Information (continued)



**CERDIP
CERAMIC DUAL-IN-LINE
PACKAGE
(0.300 in.)**

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	—	0.200	—	5.08
B	0.014	0.023	0.36	0.58
B1	0.038	0.065	0.97	1.65
C	0.008	0.015	0.20	0.38
E	0.220	0.310	5.59	7.87
E1	0.290	0.320	7.37	8.13
e	—	0.100	—	2.54
L	0.125	0.200	3.18	5.08
L1	0.150	—	3.81	—
Q	0.015	0.070	0.38	1.78
S	—	0.098	—	2.49
S1	0.005	—	0.13	—

DIM	PINS	INCHES		MILLIMETERS	
		MIN	MAX	MIN	MAX
D	8	—	0.405	—	10.29
D	14	—	0.785	—	19.94
D	16	—	0.840	—	21.34
D	18	—	0.960	—	24.38
D	20	—	1.060	—	26.92
D	24	—	1.280	—	32.51

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